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(54) Pseudoplastic compositions comprising aqueous dispersions of polysaccaride gums

(57) The pseudoplastic condition of aqueous xanthan gum is reproduced in other, less expensive gums used in the bakery trade for flan jellies and similar products, by a preparative method in which a heated solution of a polysaccharide gum is rapidly chilled. The pseudoplastic condition facilitates dispensing and application and the mobile fluid is stiffened in conventional manner to a gel by reheating and cooling. Preferred polysaccharide gums are locust bean gum, gum arabic, carrageenan, guar, furcelleran and agar.

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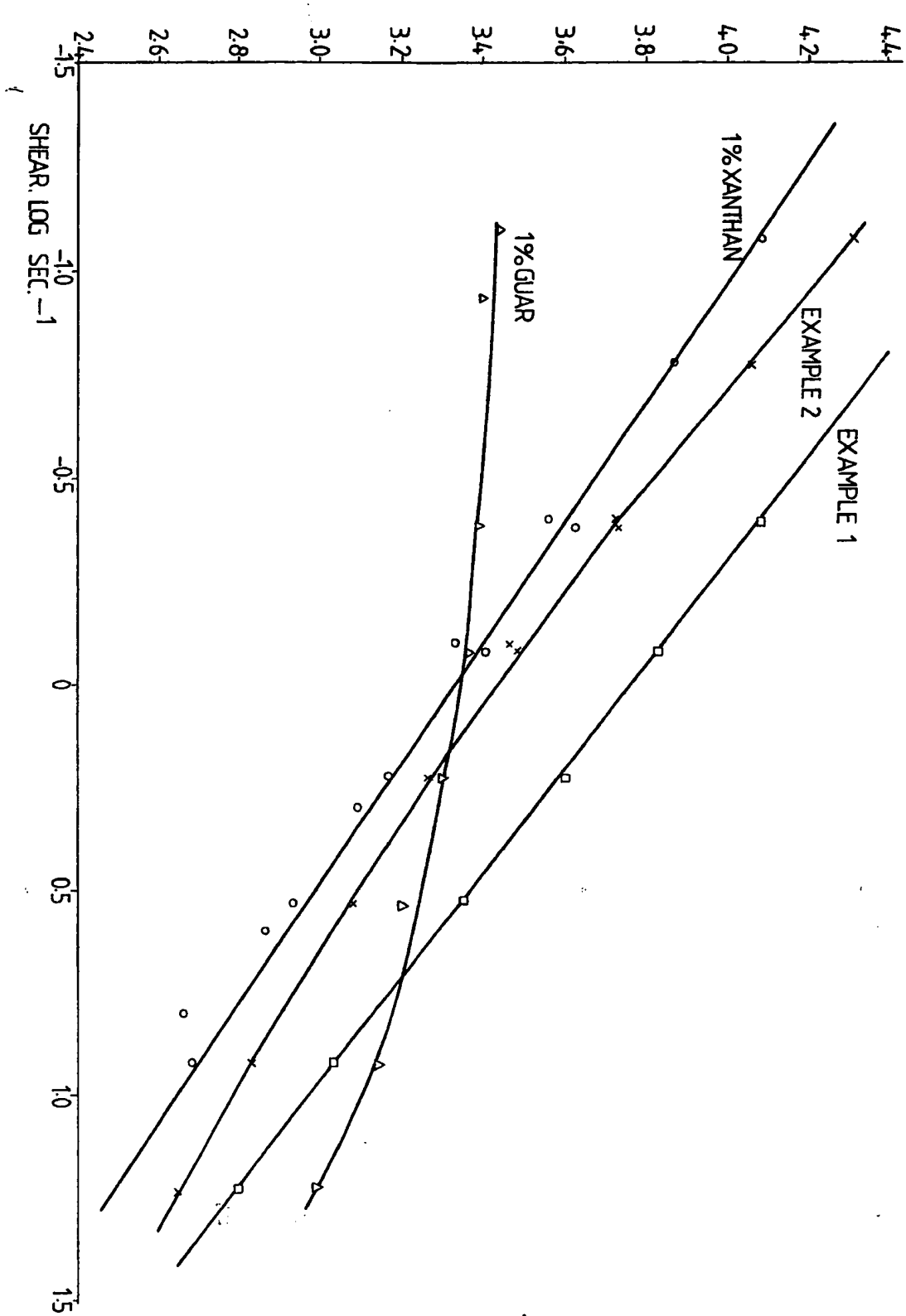
VISCOSITY
LOG m.Pas.$^{-1}$
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
-1.5
-1.0
-0.5
0
0.5
1.0
1.5
SHEAR. LOG SEC.$^{-1}$
1% XANTHAN
1% GUAR
EXAMPLE 2
EXAMPLE 1

SPECIFICATION

Edible gums

This invention relates to compositions containing edible polysaccharide gums.

Polysaccharide gums are widely used in the food industry. They are isolated as free-flowing powders containing 10-15% water and are often marketed in the form of an aqueous gel requiring further dilution before use and the addition of other ingredients such as flavours, sugar and the like in flans and cakes and other baked goods. This is then warmed to melt the gel and applied for example by pouring or brushing and sets on cooling.

The present invention provides an aqueous dispersion or solution of a polysaccgaride gum which contains 50% or more water and which remains mobile at ambient temperatures, eg, 5 to 25°C and is therefore easier to dispense accurately at these temperatures than the conventional gel form described. The gum compositions of the conventional gel form described. The gum compositions of the invention are applied in a conventional manner, the mobile liquid being diluted as required, other ingredients added the the composition heated to approximately 70°C and applied warm, eg, at 40 to 70°C. Upon cooling it sets as a normal gel.

The compositions of the invention are characterized by the fact that the gum content exhibits viscosity properties which have hitherto been unique among natural gums to zanthan gum. This is an expensive gum which exhibits unusual and distinctive properties in its abililty to control the rheology of aqueous fluid. Aqueous solutions of xanthan gum are extremely pseudoplastic; when shear stress is applied, viscosity is reduced proportionate to the amount of shear applied. Xanthan-like properties may be regarded as denoting in this specification, the properties of an aqueous composition exhibiting infintely high viscosity at zero shear. The conditions of the present invention similarly exhibit pronounced pseudoplasticity. Xanthan gum will not itself gel and is therefore mixed for this reason with other gums eg, locust gum in jellies.

Viscosity is the ratio of shear stress to rate of shear and one or other must be specified, usually the shear rate, when a viscosity measurement is stated and is defined either as an actual shear rate or as a relevant parameter of a viscometer with which the viscosity is measured. Rotational viscometers measure the torque required to rotate a cylinder in the fluid and can provide readings at a given shear rate or provide a shear-stress/shear-rate plot from zero to maximum and back again. From such graphs the rheological characteristics of fluids can be determined. A Newtonian system is a straight line, whereas all other systems, clasified as non-Newtonian, are non-linear. Among these, a pseudoplastic solution is shear-thinning, whereas a dilatant solution is shear-thickening. The viscosity of Newtonian liquids remains unchanged over changes in shear rate, whereas pseudoplastic liquids change in viscosity according to the shear rate applied to them.

The accompanying figure shows the relationship between viscosity (ordinate) and shear (abscissae) applied to 1% aqueous solutions of guar (G) and xanthan (X) gums which at this concentration and at 25°C are non-gelling. The remaining curves are examples of products of the present invention. The logarithmic values plotted show that at low shear rates there is little viscosity change with shear for the former and is tending towards Newtonian behaviour. Xanthan gum on the other hand as shown in Figure 1 exhibits a steady and marked change. Aqueous dispersions of 1% agar made according to the invention show a similar viscosity-shear relationship to that of xanthan gum and are therefore non-Newtonian at virtually all shear rates.

The invention is concerned with aqeous solutions of any natural gum including for example guar, locust bean gum, gum arabic, gelatin and more particularly, carageenan, furcelleran and agar. In general gums are preferred which are not chemically produced eg, by acids as with pectins and calcium as with alginates. These produce jellies with xanthan-like properties which are not however pourable.

The compositions of the invention may be prepared by dissolving the gum powder at elevated temperature, eg, 65 to 70°C and subjecting the hot solution to high speed chilling down to ambient temperature, eg, 5 to 25°C with vigorous agitation. This may be carried out either by indirect or direct heat exchange means. Thus, the solution may be circulated from a storage vessel through a suitable heat exchanger, eg, a plate heat exchanger or a scraped-surface heat exchanger, for example a "Votator A" unit. This method is not however suitable for chemically set gels eg, alginates and pectins.

According to another method of preparation, a concentrated solution of the gum is prepared at elevated temperature and then rapidly diluted with vigorous stirring with the remaining quantity of water and other ingredients, eg, sugar, at ambient or lower temperature to cool and further disperse the gum rapidly. The initial solution is preferably from 0.5 to 2% concentration, preferably diluted to 0.05 to 0.25%, more preferably about 0.2%.

The visco-elastic properties of the compositions according to the invention are preferably measured at 25°C on a 1% aqueous solution using a Brookfield Synchrolectric Viscometer Model LVT. In the Examples of Figure 1, readings are taken for spindles 18 and 34 over the 8 speed ranges available, viscosities being calculated using the Brookfield multiplication factor for each particular speed, viscosity being measured in centipoises and shear rate in reciprocal seconds.

An important preferred feature of the process of producing the compositions of the present invention is to exercise a considerable degree of shear on the gel in the presence of sugar in edible compositions in which this component is required.

The compositions of the invention therefore preferably include sugars, preferably from 10 to 50%, in

addition to the gum which should preferably be present in an amount from 0.1 to 10%, preferably 0.5 to 2.5%, by weight of total composition, equivalent to 2 to 10% by weight of water. The compositions of the invention appear to consist of an aqueous dispersion of a polysaccharide gel since they can be separated by centrifugal action.

Example 1

13 parts of granulated sugar were stirred into 15 parts of water at 15°C and when the sugar dissolved, stirring was continued and 42 parts of glucose syrup and 0.001 parts of Span 60 were added.

29 parts of water were stirred in a boiling pan at 15°C and 0.56 parts Danish agar furcelleran added, the cold slurry formed being stirred for 15 minutes to ensure that the agar was thoroughly wetted before heating. Steam was admitted to heating coils in the boiling pan and the slurry heated to 65°C when the hot agar solution was stirred into vortex formed by agitating the sugar solution with a Silverson Mixer in a vat fitted with a discharge pump and an in-line filter, the addition of the agar mix being adjusted to match the dispersal rate of the mixer and avoid build-up of undispersed agar mix forming lumps in the cold syrup.

0.11 parts potassium sorbate were added to the mix in the vat for stabilisation purposes, together with small amounts of colour, flavour and acetic acid, the product eventually being packed after discharge and filtration. The product was mobile liquid which after conventional treatment by heating to 70°C cooled to a firm gel.

Example 2

50 kgms of flan jelly containing 0.7% Danish agar and 17.5% sugar, together with 55% glucose syrup, were transferred after partly melting in a hot water tank, to a vat fitted with a stirrer and a steam-heated jacket to melt the jelly completely when 15.625 kgms of water and 72 gms of potassium sorbate were added with mixing. When heated to 84°C the speed of the stirrer was reduced to prevent aeration and the blend pumped through two Votator A-units in series at a rate of approximately 1 kgm per minute, a residence time in each tube of 9.8 seconds and a final product temperature of 5°C. The product was a free-flowing, clear and stable liquid which on heating to 80°C set on cooling to a firm jelly, optionally with the addition of up to 25 to 30% water.

CLAIMS

1. A pseudoplastic composition comprising an aqueous dispersion of a polysaccharide gum other than xanthan gum.

2. A composition according to Claim 1 which comprises guar, locust bean gum, gum arabic, gelatin, carrageenan, furcelleran or agar.

3. Composition according to Claim 1 or 2 in which from 2 to 10% of the gum by weight of water is dispersed.

4. A bakers' jelly comprising a pseudoplastic composition as claimed in any of the preceding claims and including from 10 to 50% sugar with colour and flavouring agents.

5. A method of preparing a pseudoplastic composition as claimed in Claim 1, comprising dissolving the gum in aqueous medium at elevated temperature and subjecting the resulting solution to highspeed chilling.

6. Process according to Claim 5, wherein the solution is chilled through a scraped-surface heat exchanger or plate heat exchanger.

7. Process according to Claim 5, wherein a concentrated solution of the gum is chilled by rapid dilution with vigorous stirring.

8. Process according to Claim 7, wherein the gum solution is diluted into a solution of sugar.

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